

Module 6

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AdaBoost Classifier

The adaboost classifier is a type of ensemble classifier which, as the name suggests, uses an ensemble of classifiers to do the final classification. In our activity, we use the decision tree classifier as our base classifier to construct an adaboost classifier. This decision tree does not have to be a "good" classifier, since the idea is to use an ensemble of "weak" classifiers to create a "strong" classifier. We can do this by setting a maximum number of leaf nodes for each of the trees. The way the adaboost classifier works is as follows :

- Given the training data consisting of the feature vectors \vec{x} belonging to class labels C_k , we first give equal weightage to all the training data points and construct a decision tree classifier $T^1(x)$.
- We then calculate the misclassification error of this decision tree by adding the weights of all the misclassified points. We then use this to calculate a weight for the tree itself, α^1 .
- Using these weights, we reweight our samples such that the misclassified samples are given more weights.
- We then construct another tree using the new weights of the samples, $T^2(x)$ and its corresponding error weight - α^2 .
- We iterate this process to create a series of decision trees, $\{T^m\}$ and the corresponding tree weights $\{\alpha^m\}$
- Given an input vector \vec{x} , we classify it based on what class prediction has the most cumulative tree weight.

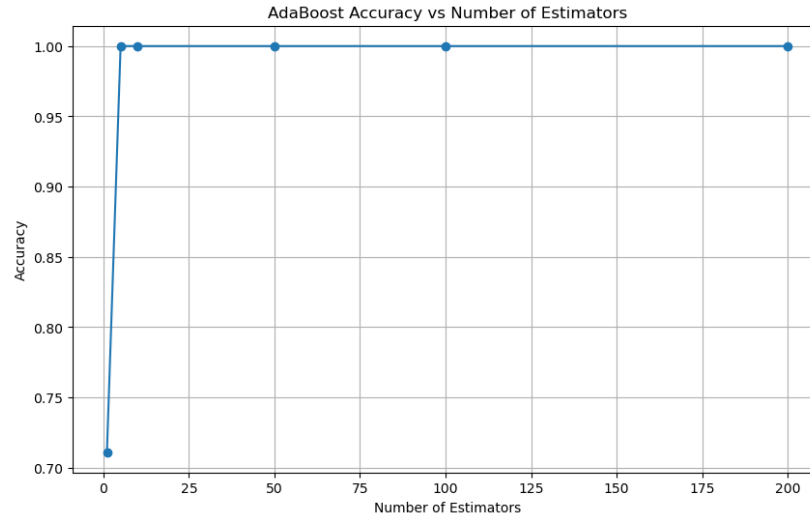


Figure 1: We test the accuracy of the adaboost classifier as a function of the number of weak learners - "estimators" used in the iteration. We notice that the accuracy converges for large number of estimators.

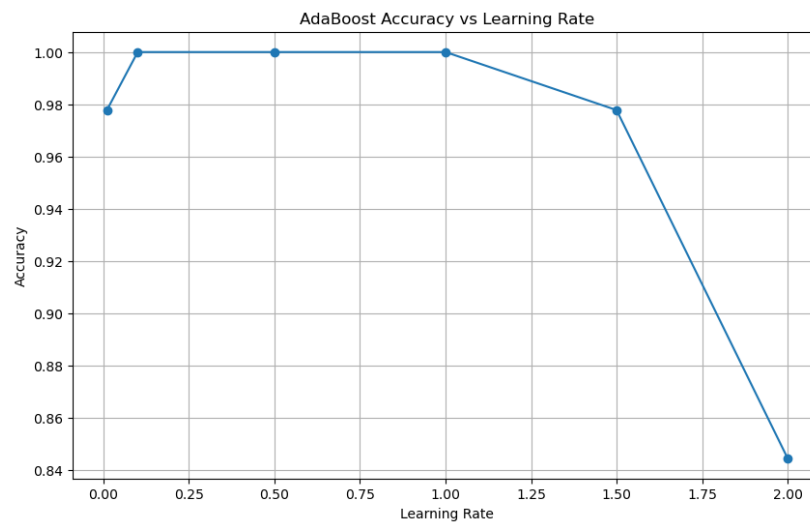


Figure 2: We test the accuracy of the adaboost classifier as a function of the learning rate. We notice that the accuracy increases upto a certain value and decreases again for larger values.

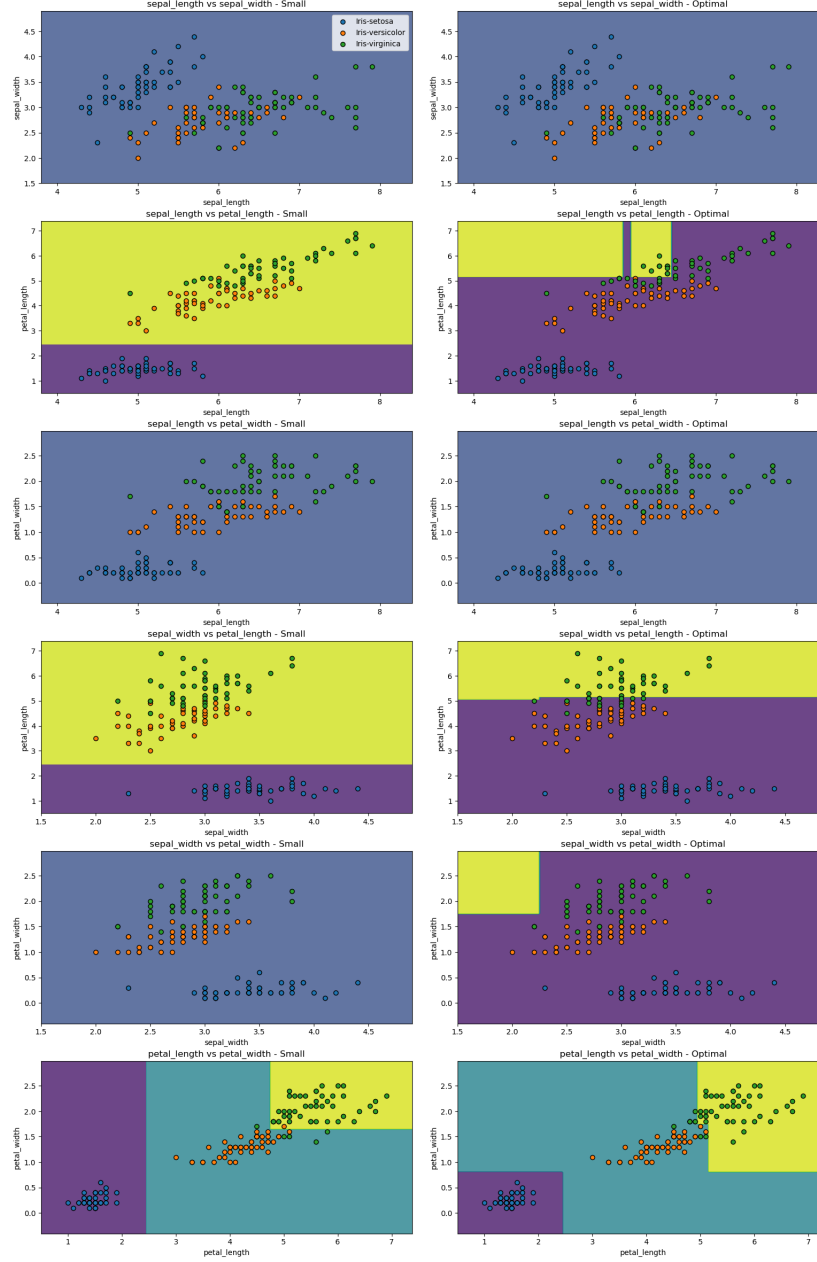


Figure 3: The decision surfaces for classification for 2 features at a time. The left column is the adaboost classifier using small number of estimators. The right column is the classifier for an optimal number of estimators

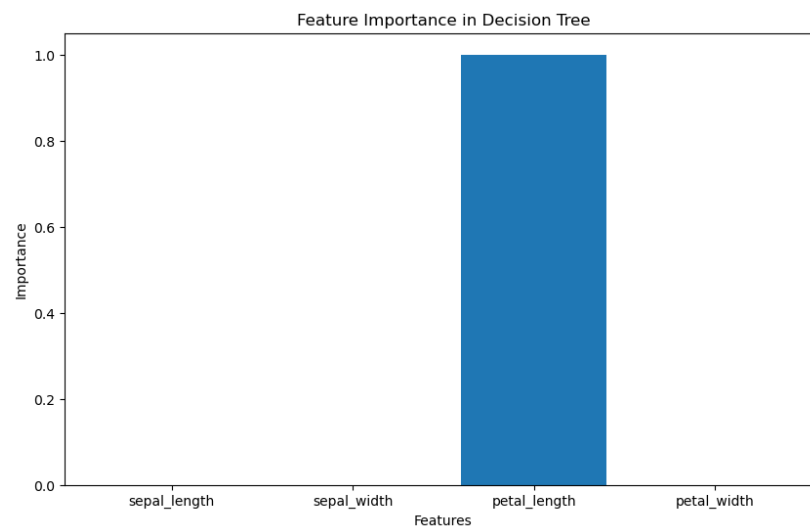


Figure 4: The importance of each of the features. We can see that the petal length is the most important feature to create a decision tree.